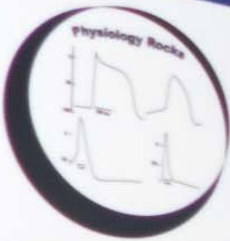


Research Day 2012



Student Presentations



Skin Tissue Water via Tissue Dielectric Constant Measurements in Persons with and without Diabetes Mellitus

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Background

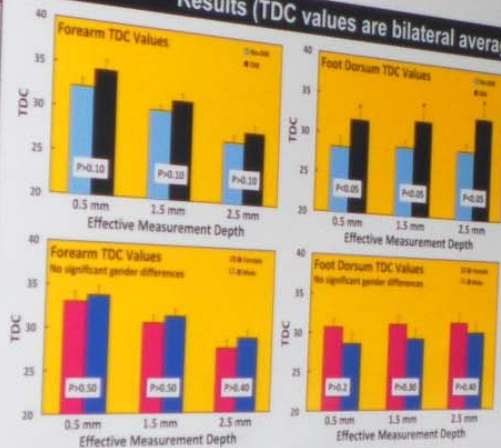
Measurements of local tissue dielectric constant (TDC) via the open-ended coaxial probe method are useful non-invasive measures of local tissue water^[1-4]. The method permits assessment and tracking of changes in skin tissue water (STW) in many situations including lymphedema^[5] and other conditions^[6-10]. The operating principle depends on the direct relationship between TDC values and fluid content within skin that includes epidermal, dermal and vascular tissues. Our specific aim was to determine if STW in persons with diabetes mellitus (DM) is less than in persons without DM (NO-DM). Our motivation stems from the fact that although microvascular and other DM-related skin changes may cause skin dryness and other complications there is no definitive data describing possible DM VS. NO-DM STW differentials.

Methods

TDC values at depths of 2.5, 1.5 and 0.5 mm were measured bilaterally on anterior forearm and foot dorsum of 36 persons; 18 with DM II and 18 without DM II. Subjects removed shoes and socks/stockings and laid supine with both hands at their sides and their feet uncrossed. Marks were made on the target site of each forearm 8 cm distal to the antecubital fossa. The target site on the foot dorsum was then marked on a flat area between the great and 2nd toe. Girths of forearm and foot at target sites were measured with a calibrated tape measure. TDC measurements were then done in triplicate at each site and each depth. NO-DM and DM groups did not differ by age (54.2 ± 18.4 vs. 62.7 ± 12.5 years, p=0.21) or BMI (28.4 ± 4.2 vs. 29.9 ± 5.2 kg/m²; p=0.36). DM duration was 133 ± 132 months and HbA1c was 7.4 ± 1.4. Graphic data are reported as bilateral averages (error bars = 1 sem).



Results (TDC values are bilateral averages)



Forearm TDC values did not differ between NO-DM and DM groups at any depth. In contrast, TDC values of the DM group were significantly greater (p<0.05) at the foot at all depths. Interestingly, the previously observed increase in TDC value with decreasing depth^[11] was here also observed at forearm but not at foot dorsum.

There was no significant difference in TDC values between genders at forearm or foot at any depth. Previous work^[11] based on a larger sample had indicated a slight but significant gender difference at the forearm in which male values exceeded female values by 13%. An opposite tendency is here seen at the foot dorsum.

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Conclusions

The greater TDC values found in persons with diabetes was unexpected and contrary to expectations. It is not consistent with the presence of a decreased skin tissue water in DM as was originally hypothesized. It may be that this increased TDC (reflecting an increase in tissue water) may reflect preclinical edema not otherwise visualized. It is also interesting that this NO-DM vs. DM differential was significant only on the foot, an anatomical area that would be especially prone to edema formation. If true, the TDC method may be a useful screening tool for early detection of DM-related edema in certain patients. Further research into this emerging and potentially useful area is clearly indicated.

This research is self-supported.
 The authors declare no competing financial interests.



Chris
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Vishall
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Sequential Variability in Localized Thigh Skin Dermal Tissue Water

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Background

Skin tissue dielectric constant (TDC) measurements have been used as a measure of local skin tissue water and its change in a variety of clinically-related applications. Reported values have been reported at various anatomical sites, but the temporal variability in lower extremity TDC values in young adults has not been previously reported. Since TDC values vary by anatomical site, such information is valuable directly as a reference and also to help set criteria for diagnostic locations in which measurements are made in patients over days or weeks. Thus the goal of this research was to use TDC measurements as part of research training program to study variability of these values over time in our attendees.

TDC Measurement Methods

The device we used to measure TDC was the MoistureProbe-2. It consists of a cylindrical probe connected to a control unit that displays the TDC value when the probe is placed in contact with the skin. A very low intensity 300MHz signal is generated within the control unit and is transmitted to the probe via the probe that is in contact with the skin. The probe acts as an open-ended coaxial transmission line. The portion of the incident electromagnetic wave that is reflected depends on the tissue dielectric constant which itself depends on the amount of free and bound water in the tissue volume through which the wave passes. Reflections occur.




Figure 1. TDC Measurement device and 1.5 mm depth probe.

Measurement Methods

Self-TDC measurements were performed by six male student research trainees on the proximal one-third of the right anterior thigh while in a seated position at five separate sessions: day 0, day 1, day 7, day 21 and day 28 (Fig. 2). Twenty-four hours prior to each session (except day 1), the students shaved the region of their anterior thigh to be measured. Self-measurements were taken with the students at rest in a seated position with the legs touching the floor for at least 5 minutes prior to taking any measurements. At each session TDC was measured in triplicate to a skin depth of about 1.5 mm, which is a depth that includes the epidermis and dermis but not the underlying hypodermis or subcutaneous fat. A person not involved with the measurements analyzed the data.


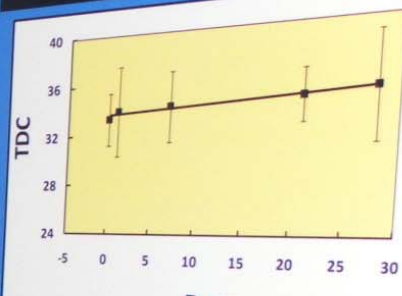


Figure 2. Self-TDC measurement with a 1.5 mm depth probe.

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Results



Days	Average TDC (mean ± SD)
0	33.2 ± 2.1
1	33.9 ± 3.6
7	34.1 ± 2.8
21	34.5 ± 2.0
28	34.9 ± 4.0

Figure 3. Average TDC values vs. Time (Error bars = ± 1 SD)

TDC values for five sequential measurement sessions (mean ± SD) were respectively 33.2 ± 2.1, 33.9 ± 3.6, 34.1 ± 2.8, 34.5 ± 2.0, and 34.9 ± 4.0. ANOVA analysis for repeated measures showed no overall time effect (p=0.629) but an increasing trend appears present for the mean values increased sequentially by 1.7%, 2.6%, 3.6% and 4.5%. It is unclear as to the cause of this apparent (but not significant) increasing trend.

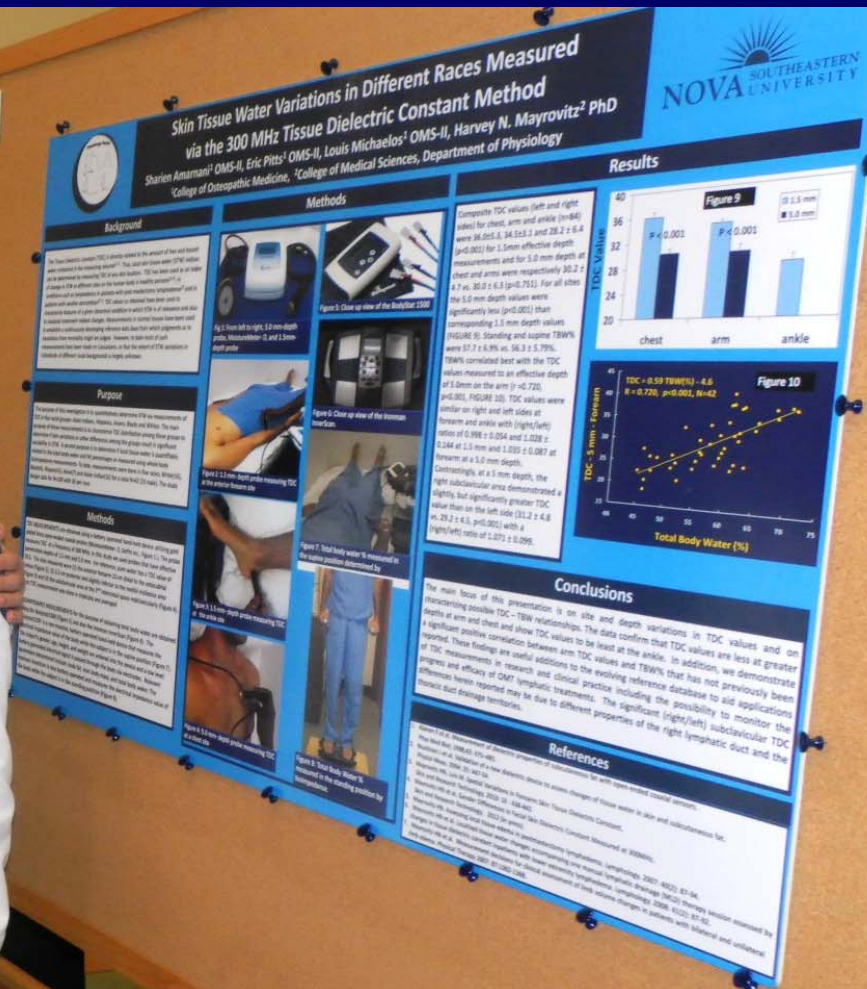
Conclusions

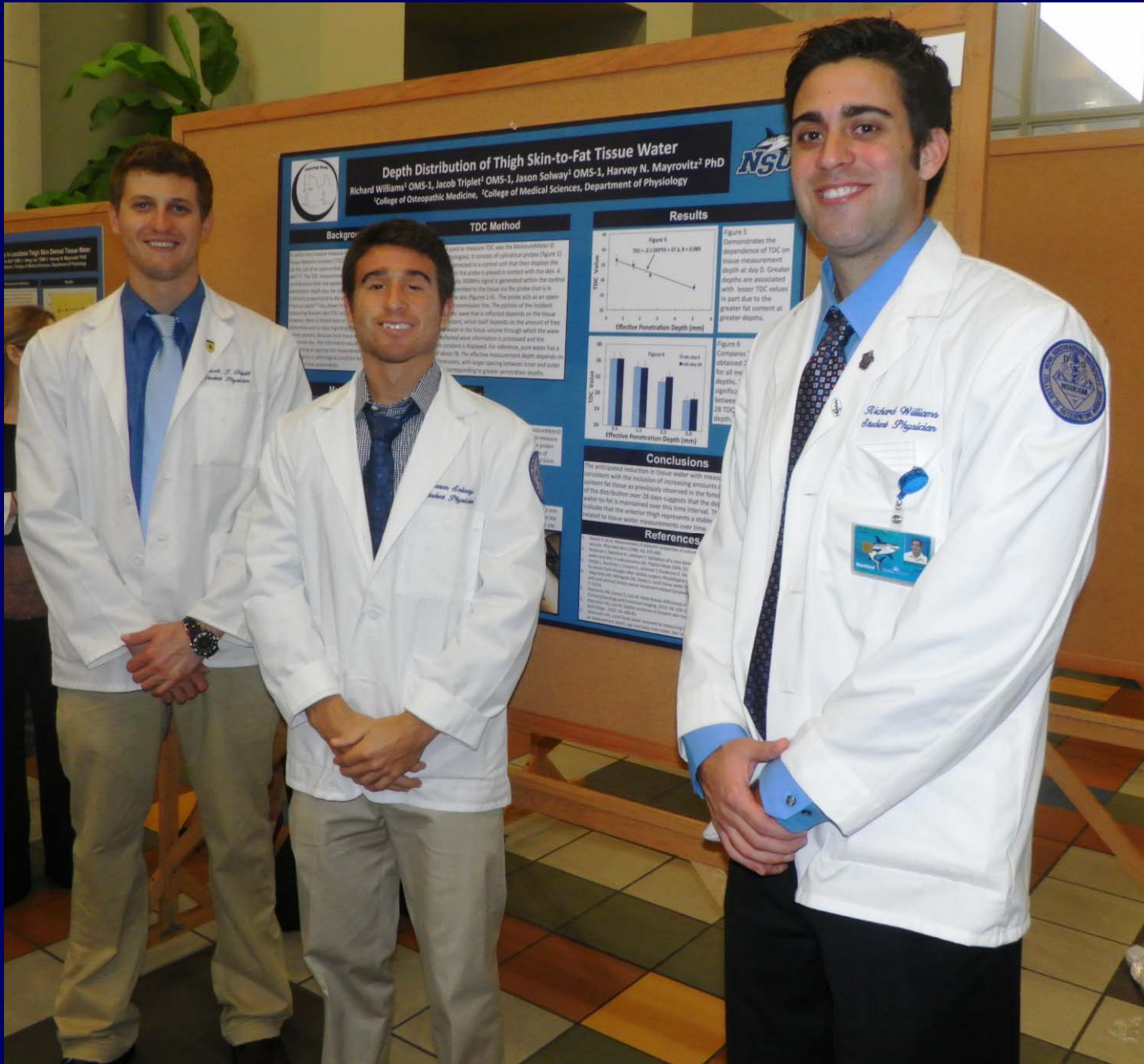
The present findings are the first documentation of the magnitude and sequential changes of thigh dermal tissue water determined by local TDC measurements. Since it is known¹⁻² that TDC values vary among anatomical sites these results add to the growing reference database of TDC values. Such reference values are needed as first steps in characterizing normal values. This value herein determined, taking into account all measurements. Interestingly, the overall average TDC value herein determined, 34.2 ± 2.8, which was similar to values previously determined in forearm dermis of 30 male subjects (33.2 ± 4.0³) and in cheek dermis (35.9 ± 4.9⁴). The maximum difference in TDC values was less than 5% and occurred between day 0 and day 28 thus indicating good measurement repeatability associated with the TDC measurement method.

Eric

Louis

Sharien





Jacob

Jason

Ricky

Tania

Lauren

Detection of Incipient Lymphedema in Women Previously Treated for Breast Cancer via Non-Invasive Tissue Dielectric Constant Measurements

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Background and Goals

It is difficult to determine the ability of lymphatic vessels to transport lymphatic fluid. Tissue dielectric constant (TDC) is a non-invasive method for measuring lymphatic vessel function. This study was designed to determine if TDC measurements could be used to detect incipient lymphedema in women previously treated for breast cancer.

Methods

Forearm and biceps TDC were measured for 100 women previously treated for breast cancer. TDC measurements were taken at the forearm, biceps, and thorax. The relationship between TDC and lymphedema was determined.

Measurement Method

The TDC is measured using a non-invasive device. The device is placed on the skin and measures the dielectric constant of the tissue.

Measurements Illustrated

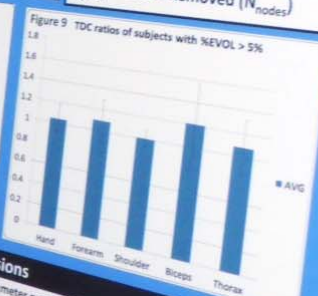
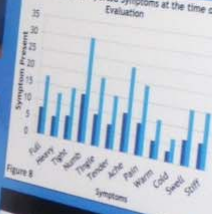
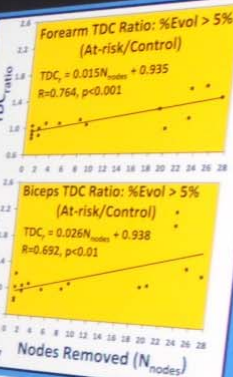


Analysis

TDC and CV were determined from girth measurements taken at the forearm, biceps, and thorax. The relationship between TDC and lymphedema was determined.

Main Results

Results show that at the time of evaluation, 34.9% of patients had NEVOL greater than 5% and 15.2% had NEVOL greater than 10%. These levels are threshold-limits often used to define lymphedema presence. Biceps TDC ratios for patients with NEVOL below and above these thresholds were 0.993 ± 0.082 vs. 1.210 ± 0.376 , $p=0.006$ (Mann-Whitney) for the 5% threshold and 1.009 ± 0.099 vs. 1.396 ± 0.508 , $p=0.027$ for the 10% threshold. At no other site were TDC values significantly different between low and high NEVOL patient subsets. However, both biceps and forearm TDC ratios positively correlated with the number of axillary nodes removed as shown in Figure 7. For patients with NEVOL >5%, Pearson correlation coefficient r-values of forearm and biceps ratio vs. number of nodes removed were respectively 0.764 ($p<0.001$) and 0.692 ($p<0.01$). TDC ratios [at-risk/control] are shown in Figure 9 for the subset of patients in whom the NEVOL was greater than 5%. Arm volume ratios showed no significant relationship to either nodes removed or time from surgery. The most widely reported symptoms (Figure 8) were arm numbness, tingling, or ache each self-reported by 43.8% of patients with NEVOL >5%. Patients with NEVOL >10% reported more symptoms.



Conclusions

These findings show that the biceps TDC ratio may be the parameter most indicative of a useful measure for early lymphedema detection, although both biceps and forearm ratios increase with increasing number of nodes removed.

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Xiaoran – M3

Forearm Skin Tissue Dielectric Constant: Effect of Changes in Vascular Volume and Skin Blood Perfusion

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Background

Measurements of local tissue dielectric constant (TDC) via the open-ended coaxial probe method are useful, non-invasive measures of local tissue water^[1-4]. The method permits assessment and tracking of changes in skin tissue water in many situations including lymphedema^[5] and other conditions^[6-11]. The operating principle depends on the direct relationship between TDC values and fluid content within measured tissue to effective depths up to about 5 mm below the epidermal surface. This depth includes dermal tissues as well as vascular structures so there is a question as to affects of blood volume and skin blood flow (SBF) on TDC values obtained. Our objective is to determine the extent to which local blood volume and SBP effect measured TDC values.

Results

Forearm Tissue Dielectric Constants

Figure 1. TDC measured for Test 1 and 2. Measurements. There is a small but statistically significant decrease in TDC with arm raising (Test 1) and a small but statistically significant increase in TDC with application of 50 mmHg pressure proximal to the TDC measurement site (Test 2).

Forearm Skin Blood Flow

Figure 2. Skin blood flow (SBF) or forearm flow measured by laser Doppler flowmetry. SBF was significantly increased with arm raising (Test 1) and significantly decreased with application of 50 mmHg pressure to the brach (Test 2).

Conclusions

Over the wider range of blood volume and SBF with correlation with the empirical measurements a 1.0 to 2.0 change in TDC values was observed. This suggests that for most clinical reduction and tracking purposes in which such large shifts in blood volume and perfusion are not likely, the confounding effects of variation in SBF or volume are not likely to be a concern with a given dependent change in vascular volume and the increase in TDC with application of full pressure is not likely to be a concern with a given pressure reduction or volume reduction.

The finding of an increase in forearm SBF agrees with common sense suggesting that venous emptying leads to arteriole vasodilation and decrease in SBP at forearm with cuff pressure was not likely with a correlation with a pressure increase reduction or volume reduction.

Methods

... to a depth of about 1.5 mm and SBF to a similar depth. Laser flowmetry were measured on the anterior forearm of adult healthy supine subjects (20 males) under resting conditions. Test 1 was done with the arm horizontal and tilted to about 90° for 5 minutes. Test 2 was done proximal before and during a 5 minute upper arm pressure of 50 mmHg. SBF was also measured during all maneuvers. The forearm target site was the cubital fossa.

Pictured below: SBF measurements taken passively with the arm at rest and BP cuff inflated to 50 mmHg.

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Matt – M3

Students and Dr. Mayrovitz



Skin Tissue Water Variations in Different Races Measured via the 300 MHz Tissue Dielectric Constant Method

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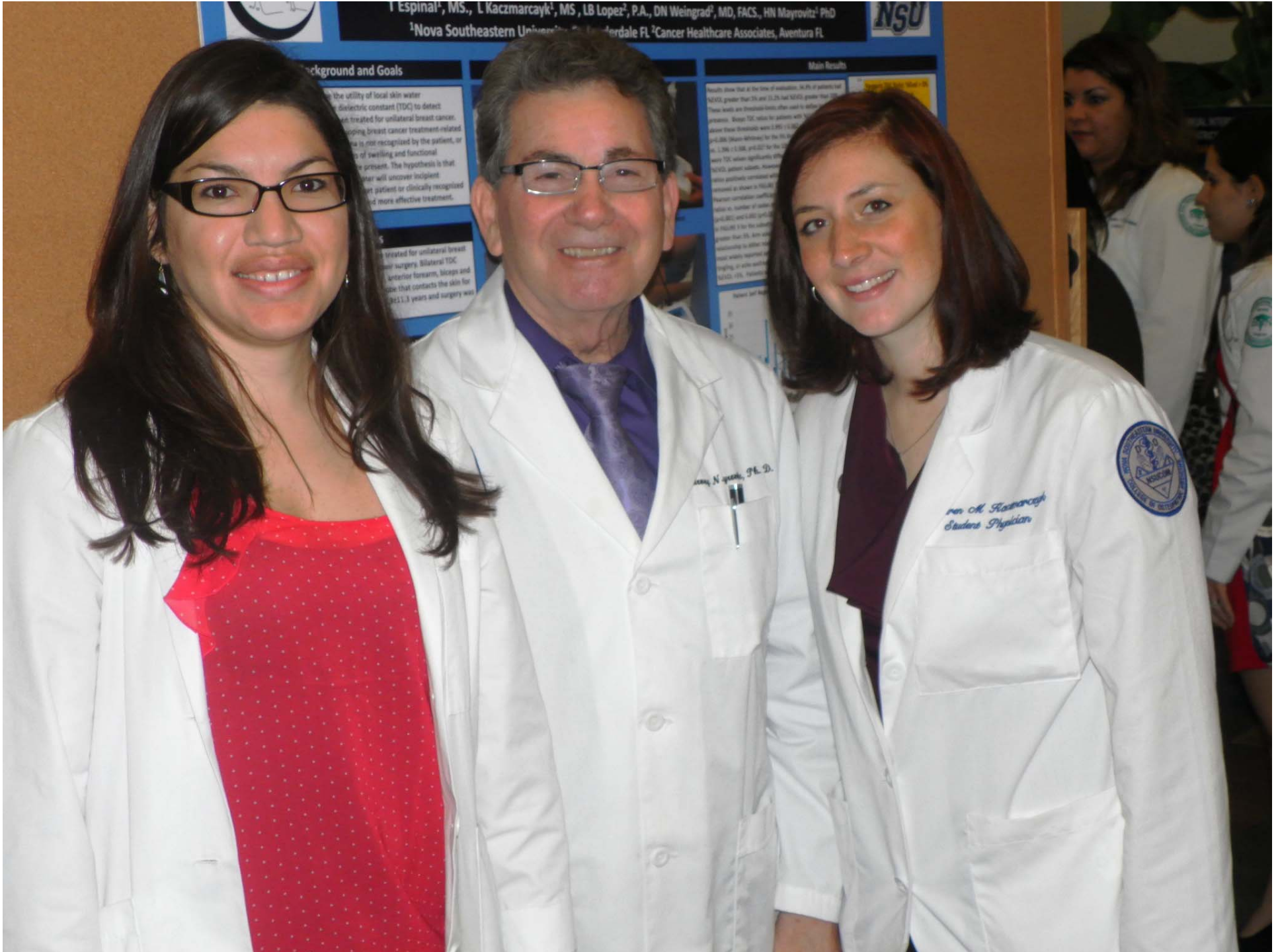
Background

The amount of free and bound water in skin tissue water (STW) indices has been used as an index of hydration in persons^{1,2,3,4}. In clinical practice^{5,6} and in research^{7,8} it has been used to assess the clinical relevance and also to make judgments as to the clinical significance of such variations in STW variations in

Results

Harvey N. Mayrovitz, Ph. D.

Louis Michaelos
Osteopathic Physician





Depth Distribution of Thigh Skin

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Background

A useful non-invasive measure of local tissue water content is the tissue dielectric constant (TDC). The TDC is measured via the use of an open-ended coaxial probe in contact with the skin^{1,2}. The TDC measurement (Figures 2-4) is the sum of contributions from the epidermis, dermis and subcutaneous tissue. Penetration depth also the subcutaneous tissue is directly proportional to the amount of water³. Previous work^{4,5} has shown this method to be useful for measuring forearm skin TDC values for a variety of individuals; however, there is limited data on TDC values in the extremities and no data regarding TDC values in clinical persons. Because local tissue water variations are common at this site, this information would be valuable in determining an appropriate measurement depth for both normal or pathological condition for both research and clinical assessments.

TDC Method

The TDC was measured for the Mammalian⁶ in a series of experimental studies (Figure 2). The TDC was measured in a control arm that then changes the probe is placed in contact with the skin. The signal is generated within the probe in the tissue via the probe tip (Figures 2-4). The probe is used to measure the TDC. The probe is used to measure the TDC. The probe is used to measure the TDC.

Results

The TDC values were measured for the Mammalian⁶ in a series of experimental studies (Figure 2). The TDC values were measured for the Mammalian⁶ in a series of experimental studies (Figure 2).

Jacob S. Triplett
Student Physician

Richard Williams, OMS-3

Richard Williams
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Sequential Variability in Localized Thigh Skin Dermal Tissue Water

Vishall Patel¹ OMS-1, Chris Bell¹ OMS-1, Heng Lee¹ OMS-1, Harvey N. Mayrovitz² PhD
¹College of Osteopathic Medicine, ²College of Medical Sciences, Department of Physiology

Background
 Tissue dielectric constant (TDC) measurements have been used as indices of local skin tissue water and its change in response to clinically-relevant applications. Topical applications of TDC have been reported at various anatomical sites, but variability in lower extremity TDC values in healthy individuals has not been previously reported. Since TDC is an anatomical site, such information is valuable for clinical reference and also to help set criteria for future studies in which measurements are made in days or weeks. Thus the goal of this research was to determine the variability of these values over time in healthy individuals.

Methods
 TDC was measured by six male students on the right thigh of the right leg at five separate occasions (day 0, 7, 14, 21, and 28 (except day 1), the day prior to the measurement with the students touching the floor). Measurements were taken at a skin depth of 1 cm, including the underlying hypodermis or dermis with the

TDC Measurement Methods
 We used to measure TDC was the MoistureMeter 2000. A cylindrical probe connected to a control unit is placed on the skin when the probe is placed in contact with the skin. The signal is transmitted to the control unit.

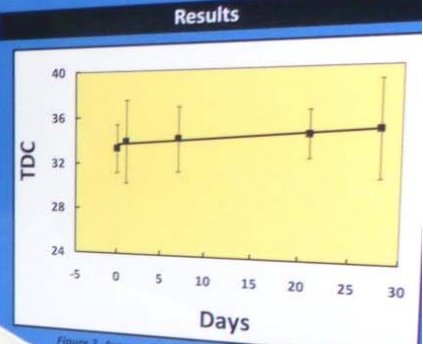
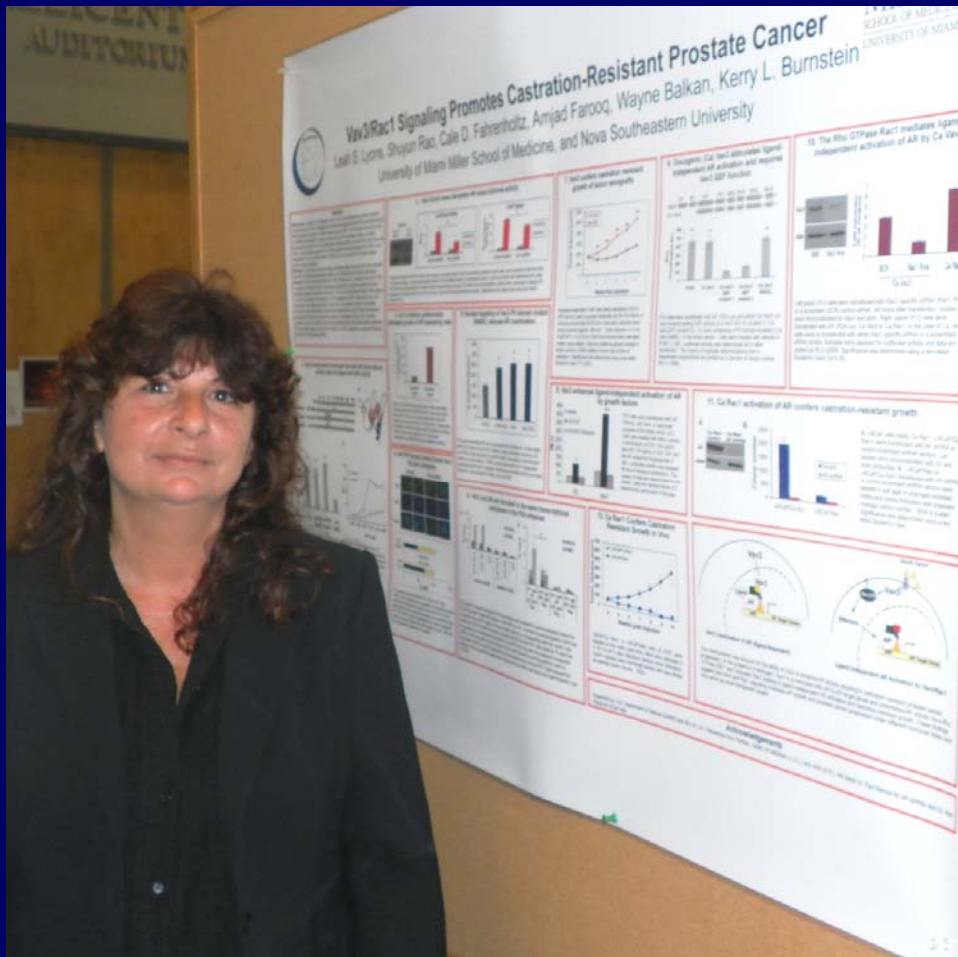


Figure 3. Average TDC values vs. Time (Error bars = ±1 SD).
 For five sequential measurement sessions (mean ± SD) were 33.3 ± 2.1, 33.9 ± 3.6, 34.1 ± 2.8, 34.5 ± 2.0, and 34.9 ± 4.0. An increasing trend appears present for the mean values. As compared to day 0, subsequent TDC mean values increased by 1.7%, 2.6%, 3.6% and 4.5%. It is unclear as to whether there is an apparent (but not significant) increasing trend.

Conclusions
 This is the first documentation of the magnitude and variability of localized thigh skin dermal tissue water determined by local TDC measurements. It is known that TDC values vary among anatomical sites and as first steps in characterizing normal values to use as reference values. Interestingly, the overall average TDC values for the thigh (33.9 ± 3.6) were similar to values previously determined in forearm (33.2 ± 4.0%) and in cheek dermis (35.9 ± 4.9%). These TDC values were less than 5% and occurred during a measurement method, indicating good measurement repeatability.

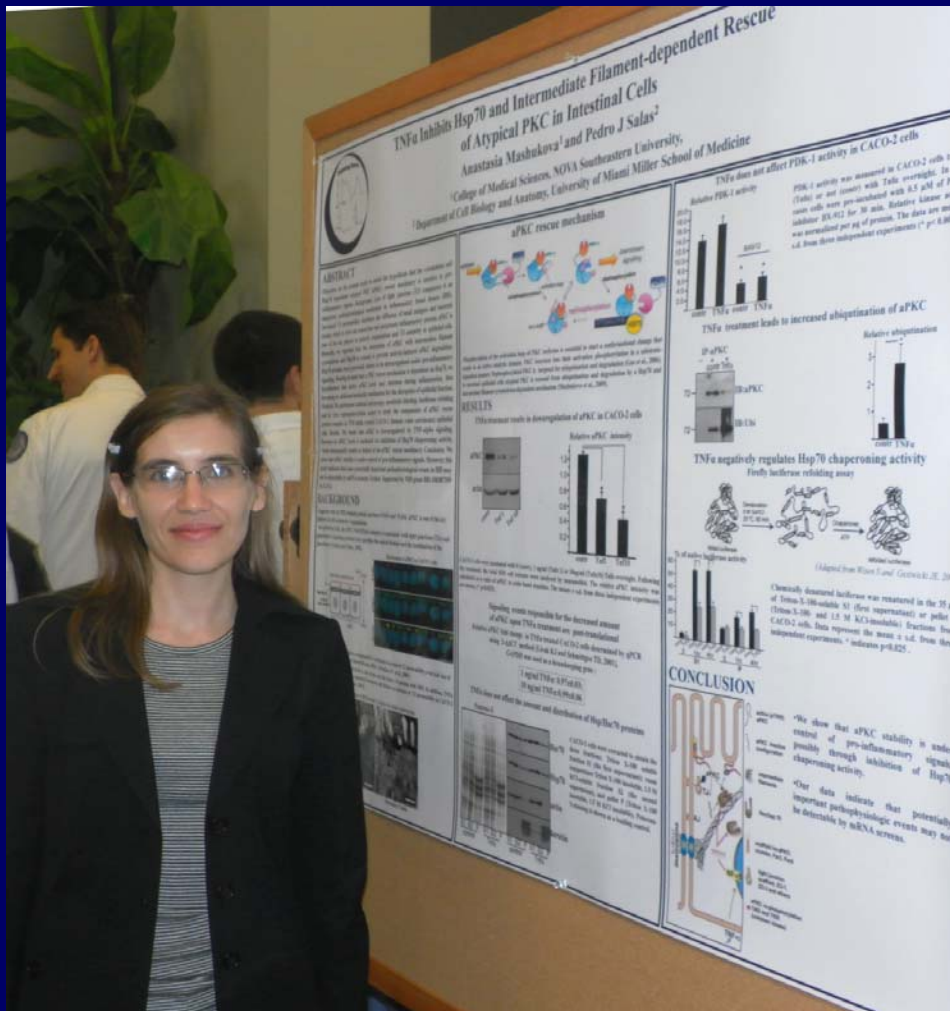


Faculty Presentations
College of Medical Sciences

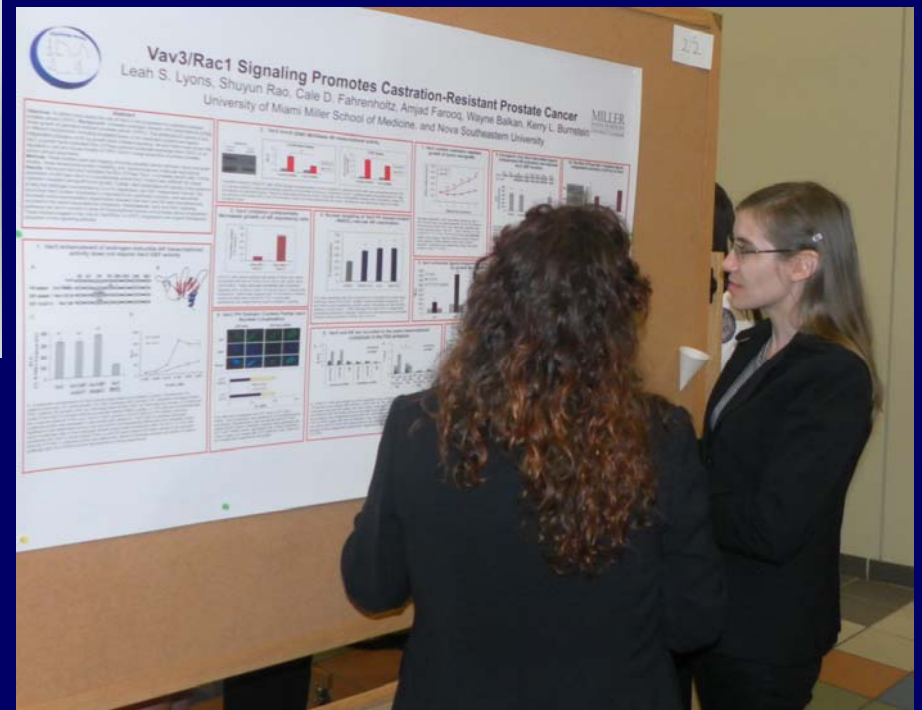


Dr. Leah Lyons
Physiology





Dr. Anastasia Mashukova
Physiology



Accessibility of the Active Site in the Enzyme Myeloperoxidase as Measured by Magnetic Resonance Studies of Solvent Proton Nuclear Spin Relaxation Effects

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Background and Objectives

The enzyme myeloperoxidase is known to have both beneficial and deleterious effects. This enzyme was originally found in neutrophils and where it plays an important beneficial role, because of its antimicrobial and cytotoxic activities. Myeloperoxidase requires hydrogen peroxide which can be produced by a sequence of reactions in which a membrane bound NADPH oxidase first generates superoxide anion followed by superoxide dismutase catalyzing the formation of hydrogen peroxide. The beneficial activities proceed by peroxidation of chloride ion to hypochlorite, chlorination of bacterial amino acids by hypochlorite and to decarboxylation of the resulting amino acid chloramines. In addition, the hypochlorite also deactivates the slow reacting substances of anaphylaxis by converting the thio-ether sulfur atom into a sulfoxide.

Deleterious effects of myeloperoxidase are known to be related to cardiovascular disease. These deleterious effects in cardiovascular tissues have been attributed to the generation of chlorotyrosine, nitrotyrosine, and tyrosyl radicals formed in these enzyme reactions. Analyses of atherosclerotic plaques have yielded these products, as well as modified low-density lipoprotein, and active myeloperoxidase embedded in the plaques. Some groups have now recommended that plasma levels of myeloperoxidase be used as an additional marker for the presence of cardiovascular disease.

The kinetics and mechanisms of some of these reactions have been clarified although not all of the details of the reaction mechanisms are known. The structure of the active site heme and its connections to the protein have been reported by X-ray crystallography. Because of the current great interest in myeloperoxidase, relevant data are reported here with respect to solution properties using magnetic resonance measurements of solvent proton spin relaxation enhancement as a means of probing accessibility of the solvent to the enzyme's active site.

The specific objectives of this study are to determine first whether there is rapid solvent accessibility to the active site heme, secondly to determine whether the binding of simple ligands near the active site affect accessibility to the active site, and thirdly to determine whether there is pH dependence of accessibility to the active site.

The native structure of the enzyme is dimeric. Each monomer has a ~60kD heavy chain and a ~15kD light chain connected by a disulfide bond. The active site contains a heme, and is on the heavy chain. The heme is covalently linked to the protein in three places causing it to be non-planar. There is an asymmetric charge distribution on the heme caused by the presence of a sulfonium ion. In the native state the heme iron has 5 unpaired electrons (i.e. high spin ferric ion), causing the enzyme to be paramagnetic. The electronic state of the iron and the asymmetry of the heme cause the enzyme to be green in its native state. This is responsible for the greenish color of pus.

MATERIALS and METHODS

Canine myeloperoxidase prepared by the method of Harrison and Schultz () with an RZ of 8.0 as measured by the ratio of absorbance at 472 and 280 nm was used in this study. Solvent proton relaxation enhancement was studied using longitudinal (spin-lattice) relaxation

times (T₁ values) were measured by the inversion-recovery or saturation-recovery methods. Ten experimental data points (in by the method of least squares were used for each T₁ measurement. Frequency dependence and temperature dependence of T₁ values were determined using a Varian XL-100 magnet by using different τ_1 units and magnet current settings. Because of the particular correlation times involved, lower field/frequency measurements were found to show greater paramagnetic relaxation enhancement effects. The lowest field studies were done using a computer-interfaced Bruker RFX2028. In studies not shown here a Bruker 9.4 GHz system was used for T₁ measurements.

RESULTS and DISCUSSION

In solutions of paramagnetic metal ion-containing enzymes the observed solvent water proton spin-lattice relaxation rate is given by:

$$\frac{1}{T_1} = \frac{1}{T_{1P}} + \frac{1}{T_{1D}} + \frac{1}{T_{1W}} \quad (1)$$

Here the subscripts refer to contributions to the spin-lattice relaxation time from paramagnetic (P), and diamagnetic (D) effects of the enzyme plus the contribution due to the solvent alone (Sol) including dissolved oxygen. The first two terms on the right hand side of the equation are dependent upon enzyme concentration while the latter is not.

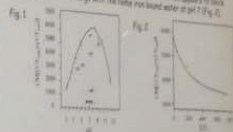
It is known from previous magnetic susceptibility, EPR data and optical spectra that myeloperoxidase has a heme in the high-spin ferric state. The presence of this paramagnetic center is likely to have an effect on water. proton relaxation rates in solutions of this enzyme. Since this paramagnetic proton relaxation rates in solutions of this enzyme, it is likely that "inner sphere" effects (i.e. due to water bound directly to the iron) will greatly outweigh the effects of water bound to more distant sites on the protein. If "outer sphere" effects are negligible, the net paramagnetic contribution to the relaxation rate is given by:

$$\frac{1}{T_1} = \frac{Mq}{111} \left(\frac{1}{T_{1W} + \tau_{1W}} \right) \quad (2)$$

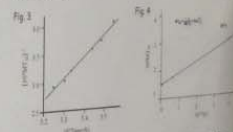
where q = number of exchangeable protons near the heme iron, and M = the concentration of the heme iron. The terms T_{1W} and τ_{1W} are the spin-lattice relaxation times of the exchangeable protons and their mean residence time respectively. Since chemical reduction of the heme iron caused precipitation of the enzyme, the paramagnetic contribution to the relaxation was estimated as the difference between relaxation rate of the native enzyme and that of the cyanide complex, since cyanide ion displaces the water molecule nearest to the heme iron and reduces the spin-state of the iron to the low spin-state.

The pH dependence of T₁ and the effect of some inhibitors is shown in Fig 1. The molar relaxivity of water in solutions of native myeloperoxidase in the middle pH range is high when compared to that of chloroperoxidase and horseradish peroxidase. Reduction of the iron by sodium dithionite causes a drop in molar relaxivity, however these solutions are unstable causing precipitation of the enzyme. The formation of a cyanide complex causes

in the molar relaxivity due to the conversion of the heme iron from high-spin (5 unpaired electrons) to low-spin (1 unpaired electron) with the cyanide ion occupying the position which was originally that of the water molecule coordinated to the iron. At high pH a low-spin complex is formed (Fig 2), because at low pH the distal histidine becomes protonated (Fig 3) and the heme effects of spin-state hydrochloride. The binding of cyanide appears to block access of solvent exchanging with the heme iron bound water of pH 7 (Fig 2).



From the temperature dependence of T₁, it can be determined whether T₁ makes a significant contribution to T₁. This question was studied at 20, 30, and 40°C. The pH dependence of the relaxation rate, T₁, increases linearly with increases in T₁ temperature indicating that T₁ is negligible (see Fig. 3) in comparison to T₁.



The frequency dependence of the paramagnetic effect was determined by measuring T₁ at three frequencies (see Fig. 4) and corresponding magnetic field strengths. Note that the frequency is converted to values for use in the field strength. The figure also confirms that the relative rate of the exchanging protons is negligible in comparison to T₁, which is a rate of the exchanging protons. The frequency dependence also allows us to estimate the correlation time that characterizes the relaxation rate in the middle of the correlation time that characterizes the relaxation rate at the Solomon-Bloembergen equation. By making appropriate modifications to the Solomon-Bloembergen equation, we can estimate the correlation time at about 10¹⁰ s⁻¹ measured.

A rearrangement of equation (2) and substitution of the theoretical correlation time T₁ in terms of T₁ and the distance from the heme iron to the exchanging water molecule allows us to calculate the approximate distance from the heme iron to the exchanging water molecule's hydrogen atoms of about 4 angstroms. This value was comparable to the distance between the heme iron and the water molecule nearest to the heme iron in the crystal. Thus the water molecule nearest to the heme iron appears to be due to rapid exchange of the heme iron bound water with that of the bulk solvent.

ACKNOWLEDGMENTS: This study would not have been done without the aid of the late Dr. J. Harrison. The author appreciates a discussion of the protein X-ray diffraction results with Dr. Peter of Univ. of Wash.

Dr. Ronald Block - Biochemistry

α -Latrotoxin Indirectly Stimulates Melanophore-stimulating Hormone Secretion from Melanotrophs of the Neurointermediate Lobe of the Lizard *Anolis carolinensis*.

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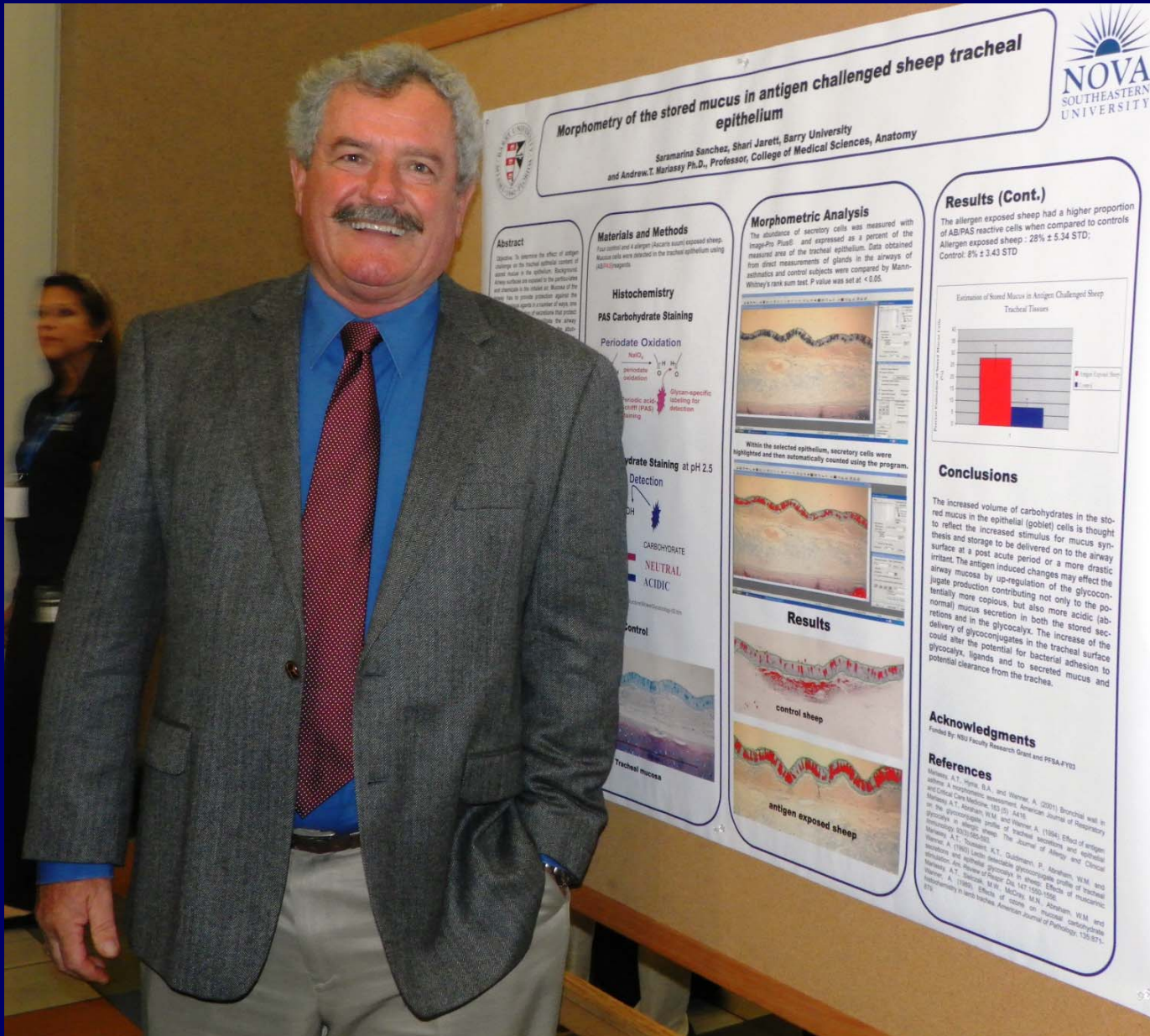
Objective: To determine the effect of α -Latrotoxin (α -Ltx), a toxin known to cause transmitter release from CNS neurons, on melanophore-stimulating hormone (MSH) secretion from the neurointermediate lobe (NIL) of the anole. **Background:** MSH secretion from the anole melanotrophs is considered to be under stimulant control exerted by factors released from neurons in the neural lobe. Since α -Ltx induces transmitter release from such neurons it was tested on MSH secretion from the anole NIL. **Methods:** NILs were either used acutely or placed in culture in a medium containing a 50:50 mixture of Hams F12 and Hams F10 in a humidified atmosphere of 5% CO₂/95% O₂ at 25° C for 7 - 10 days to allow nerve terminals in the neural lobe to degenerate. The freshly excised or cultured NILs were placed in a perfusion chamber and the MSH content of the perfusate measured by the Anolis skin bioassay. **Results:** α -Ltx (3 nM) stimulated MSH secretion from freshly excised NILs but not from cultured NILs. In both preparations high [K⁺]_o (50 mM) administered 20 min after α -Ltx exposure, produced a robust secretory response of up to 16 times basal level. **Conclusion:** The stimulant effect of α -Ltx on MSH secretion from freshly excised NILs and the lack of effect on cultured (denervated) NILs suggest that the stimulation is neurally mediated and is thus consistent with the suggestion that stimulant factors, released from nerve endings in the neural lobe, are involved in the control of MSH secretion from melanotrophs of the lizard *Anolis carolinensis*.



Figure 1. α -Ltx stimulates MSH secretion from freshly excised NILs. During a 20 min exposure to α -Ltx, MSH secretion rose to 4 times the basal level (3 ± 0.5 , mean \pm s.e.m., n = 4). After withdrawal of α -Ltx secretion returned to basal levels within 20 min. Exposure to high [K⁺]_o after α -Ltx produced a 16 fold increase (13 ± 2.6 , mean \pm s.e.m., n = 4) in MSH secretion.



Dr. Stephen Taraskevich - Physiology



Dr. Andrew Mariassy - Anatomy



Dr. HN Mayrovitz
2/11/2012

This was the best Research Day to date
Hope you all enjoyed it and the photos
Lets look forward to Research Day 2014
And always remember that
Physiology Rocks

